Mathematical Expressions in LaTeX

April 10, 2025

1 Introduction

Mathematical expressions in LaTeX are written using different formatting techniques, including subscripts, superscripts, integrals, summations, matrices, and differential equations. This document demonstrates various mathematical notations.

2 Subscripts and Superscripts

Subscripts in math mode are written as a_b and superscripts are written as a^b. These can be combined and nested to write expressions such as:

$$T^{i_1 i_2 \ldots i_p}_{j_1 j_2 \ldots j_q} = T(x^{i_1}, \ldots, x^{i_p}, e_{j_1}, \ldots, e_{j_q})$$

3 Integrals and Fractions

We write integrals using $\int$ and fractions using $\frac{a}{b}$. Limits are placed on integrals using superscripts and subscripts:

$$\int_0^1 \frac{dx}{e^x} = \frac{e-1}{e}$$

4 Greek Letters and Mathematical Operators

Lower case Greek letters are written as ω, δ, etc., while upper case Greek letters are written as Ω, Δ. Mathematical operators are prefixed with a backslash as $\sin(\beta)$, $\cos(\alpha)$, $\log(x)$, etc.

5 Summations and Products

We can express summations and products using the $\sum$ and $\prod$ symbols:

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$$

$$\prod_{k=1}^{n} k = n!$$

6 Complex Numbers and Exponential Functions

Complex numbers and exponential notation can be written as:

$$e^{i\pi} + 1 = 0$$

7 Vectors and Matrices

Vectors and matrices can be represented as follows:

$$\mathbf{v} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

$$\mathbf{A} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

8 Differential Equations

Differential equations can be written using derivatives:

$$\frac{d^2y}{dx^2} + \omega^2 y = 0$$

9 Conclusion

LaTeX provides a robust framework for writing mathematical expressions, from basic equations to advanced notations. Proper formatting ensures clarity in scientific and technical documents.